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REMARKS

Applicants respectfully request reinstatement of the Appeal filed on November 12, 2003. Applicants have filed concurrently herewith a Supplemental Appeal Brief addressing the rejections presented in the Non-Final Office Action dated January 15, 2004, which reopened prosecution.

It is believed that the Supplemental Appeal Brief places the application in condition for immediate allowance, which action is earnestly solicited.

If there are any additional charges with respect to this Request or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' Attorneys.

Respectfully submitted,

CANTOR COLBURN LLP

By


Peter R. Magerty

Registration No. 42,618

Date: February 2, 2004
Telephone (860) 286-2929
Facsimile (860) 286-0115
Customer No. 23413

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Alan C. Janos et al.)	
)	Before the Board of
Serial No.:	10/004,523)	Appeals
)	
Filed:	November 01, 2001)	
)	Appeal No.: Not yet
For:	PLASMA PROCESS AND)	assigned
	APPARATUS)	
)	Group Art Unit: 2821

SUPPLEMENTAL APPEAL BRIEF

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Axcelis Technologies, Incorporated, Beverly, Massachusetts.

II. RELATED APPEALS AND INTERFERENCES

An Appeal Brief was filed on November 12, 2003, incorporated herein by reference in its entirety. This Supplemental Appeal Brief addresses those issues raised by the Examiner in a Non-Final Office Action dated January 15, 2004, which reopened prosecution. There are no other appeals or interferences known to appellants, appellants' legal representatives, or assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

The rejection of Claims 1-36 are appealed in this Supplemental Appeal Brief. It is noted that the Office Action dated January 15, 2004, which is the subject of this Supplemental Appeal Brief, was the fifth Office Action received from the Examiner during the prosecution of the subject application.

IV. STATUS OF AMENDMENTS

An Appeal Brief was filed on November 12, 2003 addressing the final rejection of Claims 1-36. An Office Action dated January 15, 2004 (hereinafter referred to as "the Office Action") was received in response to the Appeal Brief, thereby reopening prosecution. In the

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Office Action, Claims 1-3, 6-16, 18-27, and 29-36 were rejected and Claims 4, 5, 17, and 28 were objected to. A copy of the pending claims is shown in Appendix A, attached hereto. It is noted that the pending claims, in their current form, were the subject of the appeal discussed in the above noted Appeal Brief.

V. SUMMARY OF THE INVENTION

The present invention relates generally to the fabrication of integrated circuits, and more particularly, to plasma mediated processes and apparatuses employed for fabricating the integrated circuit.

As noted in Applicant's background section, specialized tools utilized in the integrated circuit fabrication processes include, but are not limited to, photolithography tools, etchers, ashers, photostabilizers, ion implantation equipment, and the like. A significant number of these tools expose the wafer or selected portions of the wafer to a plasma. Some plasma-mediated processes employ plasma discharges that are either difficult to ignite, or ignite, but do so irreproducibly with variable delays before ignition is achieved. Once ignited, these discharges are typically sustained with lower required voltages or reduced electric fields. Unfortunately, variability in ignition can lead to variability in processing, inefficiencies, and reduced throughput.

Applicants have addressed the need for decreasing variability in plasma ignition by enhancing the ignition of a gas to form the plasma. Applicants have discovered that placing

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conductive fibers in or near a plasma discharge volume locally enhances the applied electric field so that plasma can be initiated at higher pressures, at lower electric fields, and/or in otherwise difficult gases to ignite. It is noted that the conductive fibers enhance an already existing electric field. Advantageously, the process and apparatus reduces the overall process times for igniting the gas and forming a stable plasma discharge. As a result, wafer throughput for plasma-mediated processes is increased as demonstrated by data included in the specification, thereby providing a significant commercial advantage.

In Applicants' detailed disclosure, the conductive fiber is described as being disposed in close proximity to a wall of a plasma tube, wherein the plasma discharge volume is first generated. The conductive fiber is secured to an interior wall of the plasma tube or may be coated with a protective coating. The plasma tube is generally an open-ended elongated cylindrical body fabricated from quartz, sapphire, alumina-coated quartz or like material that is used for plasma-mediated processes. The plasma tube includes a gas feed inlet at one end and plasma exhaust at the other end. The plasma exhaust is generally discharged into a processing chamber. Gases flowing through the tube are excited with an external energy source to breakdown the gases and form the plasma discharge volume.

The presence of the conductive fibers within or in close proximity to the plasma discharge volume has been found to enhance the local electric field. The conductive fiber allows charges (i.e., electrons) to accumulate at each end, thus distorting and enhancing the local electric field within the plasma tube. The conductive fibers are free from connection to an

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external voltage source. The gas flowing through the plasma tube 18 is exposed to the enhanced local electric field, breaks down, and becomes conductive. It is believed that because the fiber resistance is high relative to the volume resistance of the steady state plasma; the fiber does not couple significant energy during steady state operation. This reduces the field enhancement at the tips of the fiber during steady state operation, consequently reducing plasma disturbance and overheating of the fiber during operation.

The orientation, or angle, of the fiber with respect to the applied electric field is aligned to the applied electric field since charge separation and build-up can only occur along the length of the fiber. More preferably, the fiber is substantially parallel to the applied electric field. With a fiber of fixed length oriented at an angle not substantially parallel to the applied electric field, its effective length along the electric field is reduced by $\cos \theta$, where θ is the angle of the fiber with respect to the electric field. Thus, conductive fibers at angles perpendicular to the applied field would not enhance the electric field and breakdown of a plasma gas. However, at angles less than perpendicular to the applied field, there is enhancement of the electric field causing a reduction in the electric field breakdown point of a gas.

In summary, only those conductive fibers secured to the body of plasma tube and positioned to enhance an electric field in accordance with the teaching provided by the Applicants have resulted in decreased variability in plasma ignition. Moreover, it should be noted that the conductive fibers are not connected to a voltage power source but, rather, serve

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to enhance a local electric field and reduce an electric field breakdown point of a gas from the plasma.

VI. ISSUES

1. Whether Claims 1, 3, 9, 11, 14, 16, 19-20, and 25-26 are unpatentable under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 4,922,099 to Masuda et al.

2. Whether Claims 2, 8, 10, 12-13, 15, 18, 20-24, 27, and 29-36 are unpatentable under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 4,922,099 to Masuda et al.

VII. GROUPING OF CLAIMS

Claims 1-13 directed to a plasma tube stand together; Claims 14-24 directed to a plasma tool stand together; and Claims 25-36 directed to a process for reducing the electric field breakdown point of a gas stand together.

VIII. ARGUMENTS

1. Claims 1, 3, 9, 11, 14, 16, 19-20, and 25-26 are not anticipated under 35 U.S.C. §102(b) by U.S. Patent No. 4,922,099 to Masuda et al. (hereinafter "Masuda").

Applicants' undersigned representative incorporates by reference those arguments presented in the Appeal Brief submitted on November 12, 2003. The Examiner has substantially repeated the final rejection of those claims addressed in the Appeal Brief. In summary, Applicants submit that Claims 1, 3, 9, 11, 14, 16, 19-20, and 25-26 are not anticipated by Masuda because the reference fails to disclose at least one claim element common to these

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claims. For example, with regard to independent Claims 1 and 14, Masuda fails to disclose a plasma tube or a plasma tool including, *inter alia*, at least one conductive fiber free from connection to a voltage power source. As will be discussed in greater detail below, Masuda discloses that each one of its electrodes are connected to a voltage power source, which makes sense since Masuda is generally directed to electric field devices for generating an electric field. Without connection to a voltage power source, Masuda's devices would not function as an electric field device. With regard to independent Claim 25, Masuda fails to disclose a process for enhancing an electric field. As will be discussed in greater detail below, Masuda is directed to electric field devices for *generating* an electric field. The electric field devices require its electrodes contained therein to be connected to a voltage power source to generate the electric field. In contrast, Applicants' Claim 25 is directed to a process for *enhancing* an electric field comprising, *inter alia*, securing a conductive fiber to a surface of a plasma tube, wherein the plasma tube comprises an open ended cylindrical body, and at least one conductive fiber in contact with the body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source. Processes for enhancing the electric field are technically different from generating the electric field, the former requiring an external power source to generate the electric field that is then enhanced by the conductive fibers. Enhancing the electric field provides significant advantages for plasma ignition cycles as evidenced in Applicants' Tables I and II, which provides results for various plasma processes with and without the use of the conductive fiber in the manner claimed. The presence of the at least one conductive fiber, in the manner claimed, significantly increased wafer throughput as

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well as provided numerous other advantages relative to the same process/apparatus without the conductive fiber as claimed.

In the Office Action dated January 15, 2004, which is the subject of this Supplemental Appeal Brief, the Examiner has been very careful in not addressing whether Masuda discloses Applicants' claimed feature that the "at least one conductive fiber is free from connection to a voltage power source." In a previous Office Action dated August 12, 2003, the Examiner wrongly argued that the Masuda reference disclosed this feature. Applicants' are unclear as to why the Examiner has not addressed this feature in the present Office Action, especially since the primary focus of the previously submitted Appeal Brief was to convince the Examiner and the Board that Masuda did not teach or suggest this feature.

To anticipate a claim under 35 U.S.C. § 102, a single source must contain all of the elements of the claim. *Lewmar Marine Inc. v. Barient, Inc.*, 827 F.2d 744, 747, 3 U.S.P.Q.2d 1766, 1768 (Fed. Cir. 1987), *cert. denied*, 484 U.S. 1007 (1988). Applicants' claims to the plasma tube (Claims 1-13), and the plasma tool (Claims 14-24) have, in common, the feature that conductive fibers are secured to an open ended cylindrical body, which are free from connection to a voltage source. The claimed process (Claims 25-36) is directed to enhancing an electric field comprising, *inter alia*, securing at least one conductive fiber to a surface of a plasma tube, wherein the conductive fiber is in contact with an open ended cylindrical body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source. Masuda fails to disclose an apparatus or process that includes conductive

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fibers that are secured to an open ended cylindrical body, which are free from connection to a voltage source. For this reason alone, the anticipation rejection is improper and should be overturned.

In making the anticipation rejection, the Examiner refers to Masuda's Figures 19-22 and Column 16, lines 4-68 as providing support for showing all of Applicants' features found in independent Claims 1 and 25. In Figures 19-22, each one of the illustrated electric field devices shows a direct connection of a voltage power source (reference numeral 70) to its electrodes. All of the electrodes are connected to the voltage power source, either directly or indirectly. None of the electrodes disclosed in Masuda are free from connection to the voltage power source. In fact, Masuda is very creative in connecting its electrodes to the voltage power source by detailing the use of tunnels and through-holes in a dielectric material to provide connection of all electrodes to the voltage power source. Again, this makes sense since Masuda is directed to an electric field device for *generating* an electric field. Without connection to the voltage power source, generation of an electric field would not occur. Moreover, it is noted that the cited portions of the specification (i.e., Col.16, ll. 4-68) relied upon by the Examiner clearly describe the electrodes being charged with an AC current to generate the electric field.

When the device 96 is fed with a three phase AC high voltage from a three phase A.C. high voltage source 70 by way of terminals 66, 67, 68 and a progressive wave non-uniform electric field is generated . . .

(Masuda, Col. 16, ll. 62-66)

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Moreover, in each instance throughout Masuda's specification, reference numeral 70 is characterized as a high voltage source, which is in electrical communication with each and every electrode of the respective device, either directly or indirectly. Thus, Masuda fails to disclose that one its electrodes are free from connection to a voltage power source. In contrast, Applicants' claims include, *inter alia*, at least one conductive fiber free from connection to a voltage power source. Applicants' conductive fibers function by enhancing the electric field locally and have nothing to do with generation of an electric field as taught in Masuda. As noted in Applicants' specification, the electric field is generated by excitation of a gas to form plasma such as by microwave, radiofrequency, and the like, which is then enhanced locally by careful positioning of at least one conductive fiber within the plasma tube. In contrast, the only way disclosed by Masuda to generate an electric field is by energizing its electrodes with current from a voltage power source in electrical communication therewith. There is no disclosure of enhancing the electric field nor is there any disclosure that any of its electrodes are free from connection to a voltage power source.

With reference to the Examiner's comments regarding Claims 20 and 26, the Examiner is wrong in his analysis that Masuda discloses a light being focused.

Regarding claims 20 and 26, Masuda discloses the light source (19), wherein radiation emitted from the light source (70) is focused at the point within the plasma tube (96) See Figures 19-22.

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Reference numerals 19 and 70 refer to a high voltage source throughout Masuda's specification, wherein reference numeral 19 is consistently described as a high frequency AC high voltage source (see Masuda, Col. 8, l. 41) and reference numeral 70 as a three phase AC voltage source (see Masuda, Col. 12, l. 45). Plasma tube (96) is described as a contact type electric field curtain device (see Masuda, Col. 15, l. 4). There simply is no disclosure whatsoever of any light source nevermind a plasma tool including a light source as claimed or a process for enhancing an electric field that further includes focusing radiation emitted from a light source at a point within the plasma tube, as claimed by Applicants.

In view of the foregoing, Masuda is therefore deficient to support a section 102 rejection since not all of Applicants' claim elements are inherently or positively disclosed.

2. Claims 2, 5-8, 10, 12-13, 15, 18, 20-24, 27, and 29-36 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 4,922,099 to Masuda et al.

Applicants assert that a prima facie case of obviousness has not been made against Claims 2, 5-8, 10, 12-13, 15, 18, 20-24, 27, and 29-36. To establish a prima facie case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all of the claim limitations. Second, there must be a reasonable expectation of success. Finally, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. The teaching or suggestion to make

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the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). The Examiner has failed to meet these criteria and all of the claims are non-obvious over Masuda.

A. Masuda Fails to Teach or Suggest All of the Claim Limitations

Masuda fails to teach or suggest a process or apparatus comprising, *inter alia*, an open ended cylindrical body including the feature of at least one conductive fiber secured to the body and positioned to enhance an applied electric field, wherein the at least one conductive fiber is free from a connection to a voltage power source, as recited in Applicants' independent claims. Nowhere does Masuda teach or suggest at least one conductive fiber that is free from connection to a voltage source or positioned to enhance an applied electric field. Masuda is directed to electric field devices for generating an electric field. In order for the electric field devices to function as intended, a voltage source must be connected to the electrodes. Masuda provides no alternative means for generating an electric field. Thus, absent connection of its electrodes to the voltage power source, Masuda's electric field devices would not generate an electric field.

Generating an electric field is markedly different from enhancing an electric field from an already existing electric field generated by an external power source, e.g., excitation of a gas by microwaves, radiofrequencies, etc. Applicants' claimed plasma tube and plasma tool feature at least one conductive fiber that is free from connection to a voltage power source and is

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positioned to enhance an electric field. Similarly, Applicants' process for enhancing an electric field comprises, *inter alia*, securing at least one conductive fiber to a surface of a plasma tube, wherein the conductive fiber is in contact with an open ended cylindrical body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source. Masuda fails to teach or suggest at least these features as claimed by Applicants.

B. There is No Reasonable Expectation of Success

"Both the suggestion and the expectation of success must be found in the prior art, not in applicant's disclosure." [emphasis added] *In re Dow Chem.*, 837 F.2d 469, 473, 5 U.S.P.Q.2d 1529, 1532 (Fed. Cir. 1988). As discussed in the Summary section above, Applicant's conductive fibers, free from connection to a voltage power source, are positioned to enhance the electric field of a gas. To do this, the fibers are oriented at an angle less than perpendicular to the applied field. The conductive fibers themselves do not generate the applied field. Rather, the conductive fibers enhance the applied field. The enhancement provided by Applicants' conductive fibers is demonstrated in Applicants' Tables I and II reproduced in full below. Table I illustrates results from a conventional plasma tool without the use of conductive fibers to enhance the electric field whereas Table II illustrates the results of the same plasma tool with the conductive fibers. The electric field was generated by microwave excitation of a gas to form plasma, which was enhanced by the positioning of the conductive fibers as described in Applicants' specification and as claimed.

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Table I.

WITHOUT CONDUCTIVE FIBER					
	Low (sec.)	High (sec.)	Overhead (sec.)	Total (sec.)	Wafers per Hour
Polyoxide etch	10	40	18	68	53
Metal Etch	10	47	20	77	48
Si Trench etch	10	80	43	133	27
Metal etch (2)	10	80	43	133	27
EPROM	0	60	15	75	48
Optimized NVM	0	45	15	60	60
Typical short	10	35	15	60	60

Table II.

WITH CONDUCTIVE FIBER								
	Low (sec.)	High (sec.)	Overhead (sec.)	Total (sec.)	On time Savings (sec.)	Total time (sec.)	Wafers per Hour	% Increase in throughput
Polyoxide etch	10	40	18	68	7.5	60.5	60	12.4
Metal Etch	10	47	20	77	7.5	69.5	52	10.8
Si Trench etch	10	80	43	133	7.5	125.5	29	6.0
Metal etch (2)	10	80	43	133	7.5	125.5	29	6.0
EPROM	0	60	15	75	2.5	72.5	50	3.4
Optimized NVM	0	45	15	60	2.5	57.5	63	4.3
Typical short	10	35	15	60	7.5	52.5	69	14.3

As demonstrated in Tables I and II, the wafer throughput is significantly increased by enhancing the applied field by the use of the conductive fibers, which are free from connection to

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a voltage source and positioned to enhance the electric field. Enhancing the electric field serves to reduce the breakdown voltage of the gas. Orienting the conductive fiber to enhance the applied field is not obvious since those skilled in the art were previously of the belief that orienting the fibers at angles less than perpendicular to the applied field would cause shorts in the electric field and, if anything, make plasma ignition more difficult as opposed to less difficult.

By connecting all of its electrodes to the voltage power source, there is no reasonable expectation of success in Masuda for enhancing an electric field. In Masuda, passing a current through the electrodes generates the electric field, which is markedly different from enhancing an already existing electric field that further functions to reduce the electric field breakdown voltage of a gas. Moreover, even if one of its electrodes were unconnected to the voltage source (which is not taught or suggested by Masuda), it is unclear whether arcing issues would result since Masuda discloses the use of high voltage sources to generate its electric field with the electrodes.

A finding of "obvious to try" does not provide the proper showing for an obviousness determination. An Examiner, then, cannot base a determination of obviousness on what the skilled person in the art might try or find obvious to try. Rather, the proper test requires determining what the prior art would have led the skilled person to do. For reasons discussed above, Masuda would not lead one skilled in the art to fabricate Applicants' claimed plasma tube and plasma tool or practice its process for enhancing an electric field absent some form of motivation or suggestion, of which there is none.

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C. There is No Motivation or Suggestion in Masuda to Modify its Electric Field Devices

Even assuming that all elements of the claims are disclosed in Masuda, which they are not, an Examiner cannot establish obviousness by locating references that describe various aspects of a patent applicant's invention without also providing evidence of the motivating force which would have impelled one skilled in the art to do what the patent applicant has done. *Ex parte Levengood*, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. Int. 1993). The references, when viewed by themselves and not in retrospect, must suggest the invention. *In Re Skoll*, 187 U.S.P.Q. 481 (C.C.P.A. 1975). Here, the Examiner is relying on a single reference. Applicants have carefully studied and can find no such motivation or suggestion in Masuda to modify its electric field devices such that at least one of the electrodes would be free from connection to a voltage power source. The reference when viewed as a whole simply does not suggest or motivate one skilled in the art to make the modifications necessary to arrive at Applicants' claimed invention. In Masuda, each of the electrodes in the electric field device produces an electric field through a dielectric upon being energized with the voltage power source. Masuda's patent devotes much time and goes through great pains to make these conductors connect through tunnels and holes, through dielectrics, in order to connect all conductors. Based on the intended use of the electrodes to generate the electric field, there is no motivation whatsoever to modify the reference to include at least one conductive fiber that is free from connection to a voltage power source as claimed by Applicants and/or positioned to enhance an electric field, especially given

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the complexity Masuda teaches with regard to its electrodes functioning as an electric field device. A conductive fiber free from connection to a voltage power source in Masuda's electric field device would have no purpose, would not function as intended, and would not produce an electric field as intended. Moreover, one of ordinary skill in the art, based on existing knowledge, would not be motivated to free the connection of any of the electrodes described in Masuda's electric field devices from a voltage source since it would no longer function as intended.

It should also be pointed out that simply turning off Masuda's electric field devices does not remove its connection to the voltage power source as alluded to during discussions with the Examiner's Supervisor. The reference must teach or suggest all of the claim limitations. Masuda fails to teach or suggest at least one conductive fiber that is free from connection to a voltage source as claimed by Applicants.

Moreover, with regard to the rejection of Claims 6-7, 13, 22, and 30, the Examiner is wrong with regard to his conclusion that a conductive fiber having a thickness less than about 100 microns, or a length less than about 10 millimeters, or a length of about 3 millimeters to about 5 millimeters are obvious matters of design choice. Regarding thickness and length, as discussed in paragraph [0039], the dimensions and resistivity of the fiber are chosen so that the fiber effectively enhances the electrical field, yet is resistive enough so that the fiber does not couple significant energy during steady state operation.

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Regarding Claims 12, 21, and 27, the Examiner is wrong with regard to his conclusion that it would have been an obvious matter of design choice to have an energy source selected from the group consisting of microwaves, radiofrequency energy, and combinations thereof. Masuda is directed to an electric field device that requires passing a current through electrodes to generate the electric field. There is no suggestion that the electric field would be generated in any other manner. Why would anyone skilled in the art modify the electric field devices of Masuda with other energy sources to generate the electric field. This appears counterintuitive since Masuda's invention is the electric field device that uses the electrode structure and voltage power source to form the electric field. As such, Applicant's claimed energy sources would not be an obvious matter of design choice. As far as the Examiner's additional comments that securing the conductive fiber to the body at an angle substantially parallel to a length of the body is also an obvious matter of design choice, or does not solve any stated problem, or is for any particular purpose, clearly demonstrates the Examiner's lack of understanding. Applicants' paragraph [0041] discusses that the conductive fiber must be carefully positioned to enhance the electric field. Data is presented in Applicants' Figure 5 demonstrating the teachings provided by the Applicants. Based on this, one of ordinary skill in the art would not consider securing the conductive fiber to the body at an angle substantially parallel to a length of the body to be an obvious matter of design choice.

Likewise, the Examiner's comments with regard to Claim 31-36 are not obvious matters of design choice as alluded to by the Examiner. With regard to Claims 31, 35, and 36,

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Applicants have discovered that enhancing the electric field as claimed by Applicants provides some benefits specific to operating atmospheres employed excitation of gases to form plasma. Enhancing the electric field reduces the breakdown voltage of a gas so as to permit plasma formations under atmospheric conditions previously unattainable. Regarding Claims 32-34, separating each additional conductive fiber by a distance greater than 3 millimeters is not an obvious matter of design choice. Applicants have discovered as discussed in paragraph [0042] that sufficient fiber separation for most plasma tools may be maintained by spacing the ends of opposing fibers such that the localized discharges (i.e., electron clouds) created by adjacent fiber tips do not interfere (i.e., shield) each other. This translates into a separation of approximately 3 mm. These discoveries are clearly not obvious matters of design choice.

In addition, it is also pointed out that Independent Claim 25 is further distinguished because Masuda does not teach or suggest a process for reducing an electric field breakdown point of a gas. If anything, Masuda can be interpreted as teaching away from a process for reducing the electric field breakdown point of a gas since it is generally directed to generating an electric field by energizing electrodes with a voltage power source. All of the electrodes are energized by connection with a voltage source presumably to maximize the electric field generated. Since Masuda is concerned with generating an electric field, it seems counterintuitive to include conductive fibers in its electric field device since these clearly would not generate the electric field as intended by Masuda. As such, there is no disclosure or suggestion of reducing the electric field breakdown point of a gas. Moreover, in Masuda, the electric field is strongest at

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the sides of the conductors, where most of the work is done and, in addition, it is noted that the electric field is across the dielectric. This is markedly different from Applicants' conductive fibers, wherein the electric field occurs in a volume of gas by an external power source such as by microwave and the discharge created by the fibers occurs at the ends.

In view of the foregoing, independent Claims 1, 14, and 25 are patentably distinguished from Masuda since Masuda fails to establish a prima facie case of obviousness. Likewise, dependent Claims 2, 5-8, 10, 12-13, 15, 18, 20-24, 27, and 29-36 are patentably distinguished from Masuda since these claims also include the features recited in the base claim.

IX. CONCLUSION:

In view of the foregoing, it is urged that the final rejection of Claims 1-36 be overturned and Claims 1-36 be allowed. The most recent non-final rejection is in error and should be reversed.

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If there are any additional charges with respect to this Supplemental Appeal Brief, please charge them to Deposit Account No. 06-1130 maintained by Applicant's attorneys.

Respectfully submitted,

CANTOR COLBURN, LLP

By: 

Peter R. Hagerty
Registration No. 42,618

Date: February 2, 2004
Telephone (860) 286-2929
Facsimile (860) 286-0115
Customer No. 23413

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APPENDIX A: PENDING CLAIM STATUS

1. A plasma tube comprising:

an open ended cylindrical body, wherein the body includes a gas inlet at one end, and an outlet at an other end; and

at least one conductive fiber secured to the body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source.
2. The plasma tube according to claim 1, wherein a portion of the conductive fiber is encased within a protective coating.
3. The plasma tube according to claim 1, wherein a portion of the conductive fiber is in contact with the body.
4. The plasma tube according to claim 1, wherein the conductive fiber comprises a material selected from the group consisting of tantalum, tungsten, gold, copper, silver, molybdenum, aluminum, carbon, graphite, palladium, platinum, ceramics, and composites or compositions comprising at least one of the foregoing materials.
5. The plasma tube according to claim 1, wherein the conductive fiber is a platinum coated silicon carbide fiber.
6. The plasma tube according to claim 1, wherein the conductive fiber comprises a length of less than about 10 millimeters.
7. The plasma tube according to claim 1, wherein the conductive fiber comprises a length of about 3 millimeters to about 5 millimeters.

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8. The plasma tube according to claim 1, wherein the cylindrical body comprises a material selected from the group consisting of sapphire, quartz, alumina coated quartz and combinations comprising at least one the materials.
9. The plasma tube according to claim 2, wherein the protective coating comprises a dielectric material.
10. The plasma tube according to claim 9, wherein the dielectric material is silicon dioxide.
11. The plasma tube according to claim 1, wherein the conductive fiber is secured to an inner surface of the plasma tube.
12. The plasma tube according to claim 8, wherein the conductive fiber is secured to the body at an angle substantially parallel to a length of the tube.
13. The plasma tube according to claim 8, wherein the at least one fiber has a thickness less than about 100 microns.
14. A plasma tool comprising:

a plasma generating chamber comprising a plasma tube, wherein the plasma tube comprises an open ended cylindrical body, wherein the body includes a gas inlet at one end an outlet opening at an other end, and at least one conductive fiber secured to the body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source; and

an energy source in operative communication with the plasma tube.
15. The plasma tool according to claim 14, wherein the energy source is selected from the group consisting of microwave energy, radiofrequency energy, and a combination comprising at least one of the foregoing energy sources.

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16. The plasma tool according to claim 14, wherein the conductive fiber is encased with a dielectric material.
17. The plasma tool according to claim 14, wherein the conductive fiber comprises a material selected from the group consisting of tantalum, tungsten, molybdenum, aluminum, carbon, graphite, palladium, gold, copper, silver, platinum, ceramics, and composites or compositions comprising at least one of the foregoing materials.
18. The plasma tool according to claim 14, wherein the conductive fiber is a platinum coated silicon carbide fiber.
19. The plasma tool according to claim 14, wherein the conductive fiber is secured to an inner surface of the plasma tube.
20. The plasma tool according to claim 14, further comprising a light source, wherein radiation emitted from the light source is focused at a point within the plasma tube.
21. The plasma tool according to claim 20, wherein the radiation comprises ultraviolet radiation.
22. The plasma tool according to claim 20, wherein the at least one fiber has a thickness less than about 100 microns.
23. The plasma discharge tool according to claim 14, wherein the at least one fiber is at least partially aligned with the electric field.
24. The plasma discharge tool according to claim 14, wherein the at least one fiber is at substantially parallel to the applied electric field.

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25. A process for reducing the electric field breakdown point of a gas, the process comprising:

securing a conductive fiber to a surface of a plasma tube, wherein the plasma tube comprises an open ended cylindrical body, wherein the body includes a gas inlet at one end, an outlet at an other end, and at least one conductive fiber in contact with the body and positioned to enhance an electric field, wherein the at least one conductive fiber is free from connection to a voltage power source;

flowing a gas into the gas inlet of the plasma tube;

applying an electric field to the gas flowing in the plasma tube to form a plasma; and

discharging the plasma from the outlet of the plasma tube.

26. The process according to claim 25, further comprising focusing radiation emitted from a light source at a point within the plasma tube.

27. The process of claim 25, wherein the applied electric field is generated from an energy source selected from the group consisting of microwave energy, radiofrequency energy, and combinations comprising at least one of the energy sources.

28. The process of claim 25, wherein the conductive fiber comprises a material selected from the group consisting of tantalum, tungsten, gold, copper, silver, molybdenum, aluminum, carbon, graphite, palladium, platinum, ceramics, and composites or compositions comprising at least one of the foregoing materials.

29. The process of claim 25, wherein the conductive fiber is secured to the body at an angle substantially parallel to the plasma tube.

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30. The process of claim 25, wherein the at least one fiber has a thickness less than about 100 microns.
31. The process of claim 25, wherein the gas flows at a pressure less than 1 atmosphere.
32. The plasma tube according to claim 1, wherein the at least one conductive fiber is separated from an additional conductive fiber by a distance greater than about 3 millimeters.
33. The plasma tube according to claim 14, wherein the at least one conductive fiber is separated from an additional conductive fiber by a distance greater than about 3 millimeters.
34. The process according to claim 25, further comprising securing an additional conductive fiber to the plasma tube positioned to enhance the electric field, wherein the additional conductive fiber is separated from the conductive fiber by a distance greater than about 3 millimeters.
35. The process according to claim 25, wherein the gas flows at a pressure greater than 1 atmosphere.
36. The process according to claim 25, wherein the gas flows at a pressure up to about 5 atmospheres.